

WHAT IS CLAIMED IS:

1 1. A system for improving performance of wireless
2 communications comprising:

3 a transmitter producing a modulated data signal
4 combined with one or more supplemental signals on various
5 frequencies within a monocarrier channel employed to
6 transmit the modulated data signal; and

7 a receiver employing the one or more supplemental
8 signals to compute a frequency domain channel estimate for
9 use in equalizing the channel during demodulation of the
10 data signal.

11 2. The system as set forth in Claim 1 wherein the
12 one or more supplemental signals each employ a different
13 frequency which changes during each of a plurality of
14 periods, wherein the time-varying frequency for each
15 supplemental signal changes from one period to a subsequent
16 period in a predetermined sequence of frequencies within
17 the channel.

18 3. The system as set forth in Claim 2 wherein the
19 predetermined sequence spans frequencies within the channel
20 to directly provide a frequency domain channel estimate.

1 4. The system as set forth in Claim 2 wherein the
2 predetermined sequence is coordinated with a field sync
3 within the modulated data signal.

1 5. The system as set forth in Claim 2 wherein the
2 one or more supplemental signals are each transmitted with
3 a power selected to minimize interference with demodulation
4 of the data signal without reference to the one or more
5 supplemental signals.

1 6. The system as set forth in Claim 2 wherein the
2 time varying frequency cycles through all frequencies
3 within the predetermined sequence at a rate sufficient to
4 permit multiple channel estimates for a single field of the
5 modulated data signal.

1 7. The system as set forth in Claim 2 wherein the
2 predetermined sequence is coordinated with a field sync
3 within the modulated data signal and wherein the one or
4 more supplemental signals are each transmitted with a power
5 selected to minimize interference with demodulation of the
6 data signal without reference to the one or more
7 supplemental signals.

1 8. A transmitter for improved wireless communic-
2 ations comprising:

3 a symbol source producing a data signal;

4 a waveform generator producing a time-varying
5 signal which changes frequency during each of a plurality
6 of periods, wherein the frequency changes from one period
7 to a subsequent period in a predetermined sequence of
8 frequencies within a channel to be employed in transmitting
9 the data; and

10 a modulator producing a transmission signal from
11 a combination of the data signal and the time-varying
12 signal.

1 9. The transmitter as set forth in Claim 8 wherein
2 the predetermined sequence spans the channel to directly
3 provide a frequency domain channel estimate.

1 10. The transmitter as set forth in Claim 8 wherein
2 the predetermined sequence is coordinated with a field sync
3 within the data signal.

1 11. The transmitter as set forth in Claim 8 wherein
2 the time-varying signal is transmitted with a power
3 selected to minimize interference with demodulation of the
4 data signal without reference to the time-varying signal.

1 12. The transmitter as set forth in Claim 8 wherein
2 the time varying signal cycles through all frequencies
3 within the predetermined sequence at a rate sufficient to
4 permit multiple channel estimates for a single field of the
5 data signal.

1 13. The transmitter as set forth in Claim 8 wherein
2 the predetermined sequence is coordinated with a field sync
3 within the data signal and wherein the time-varying signal
4 is transmitted with a power selected to minimize
5 interference with demodulation of the data signal without
6 reference to the time-varying signal.

1 14. The transmitter as set forth in Claim 8 wherein
2 the time-varying signal is one of a plurality of time-
3 varying signals each having a different frequency during a
4 period and each changing frequency from one period to a
5 subsequent period in the predetermined sequence of
6 frequencies.

1 15. A receiver for improved wireless communications
2 comprising:

3 an equalizer performing channel equalization on a
4 received signal utilizing a channel estimate; and

5 a coherent demodulator producing the channel
6 estimate from the received signal and a time-varying signal
7 corresponding to a portion of the received signal, wherein
8 the time-varying signal changes frequency during each of a
9 plurality of periods, wherein the frequency changes from
10 one period to a subsequent period in a predetermined
11 sequence of frequencies within a channel on which the
12 received signal is received.

1 16. The receiver as set forth in Claim 15 further
2 comprising:

3 a waveform generator producing the time varying-
4 signal, wherein a period duration and the predetermined
5 sequence match a corresponding period duration and
6 predetermined sequence employed in generating the received
7 signal.

1 17. The receiver as set forth in Claim 16 wherein the
2 waveform generator produces a plurality of time-varying
3 signals each having a different frequency during a period
4 and each changing frequency from one period to a subsequent
5 period in the predetermined sequence of frequencies,
6 wherein the coherent demodulator produces the channel
7 estimate from the received signal and each of the time-
8 varying signals.

1 18. The receiver as set forth in Claim 15 wherein the
2 predetermined sequence spans frequencies within the channel
3 to directly provide a frequency domain channel estimate.

1 19. The receiver as set forth in Claim 15 wherein the
2 predetermined sequence is coordinated with a field sync
3 within the received signal.

1 20. The receiver as set forth in Claim 15 wherein the
2 time varying frequency cycles through all frequencies
3 within the predetermined sequence at a rate sufficient to
4 permit multiple channel estimates for a single field of the
5 received signal.

1 21. The receiver as set forth in Claim 15 further
2 comprising:

3 a channel estimate post-processor smoothing the
4 channel estimate, tracking time varying fades within the
5 channel estimate, and producing Doppler estimates for the
6 channel estimate.

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1 22. A method of wireless communication comprising:
2 combining a data signal with one or more
3 supplemental signals on various frequencies within a
4 monocarrier channel; and
5 employing the one or more supplemental signals to
6 compute a frequency domain channel estimate for use in
7 equalizing the channel during demodulation of the data
8 signal.

1 23. The method as set forth in Claim 22 wherein the
2 step of combining a data signal with one or more
3 supplemental signals on various frequencies within a
4 monocarrier channel further comprises:

5 combining the data signal with one or more
6 supplemental signals each employing a different frequency
7 which changes during each of a plurality of periods,
8 wherein the time-varying frequency for each of the supple-
9 mental signals changes from one period to a subsequent
10 period in a predetermined sequence of frequencies within
11 the channel.

1 24. The method as set forth in Claim 23 further
2 comprising:

3 periodically changing a frequency for each
4 supplemental signal in a predetermined sequence spanning
5 frequencies within the channel to directly provide a
6 frequency domain channel estimate.

1 25. The method as set forth in Claim 23 further
2 comprising:

3 coordinating the predetermined sequence with a
4 field sync within the data signal.

1 26. The method as set forth in Claim 23 further
2 comprising:

3 sweeping each supplemental signal through all
4 frequencies within the predetermined sequence at a rate
5 sufficient to permit multiple channel estimates for a
6 single field of the data signal.

1 27. The method as set forth in Claim 22 further
2 comprising:

3 providing each of the supplemental signals with a
4 power selected to minimize interference with demodulation
5 of the data signal without reference to the one or more
6 supplemental signals.

1 28. The method as set forth in Claim 22 further
2 comprising:

3 periodically changing a frequency for each
4 supplemental signal in a predetermined sequence of
5 frequencies within the channel coordinated with a field
6 sync within the data signal; and

7 providing each of the supplemental signals with a
8 power selected to minimize interference with demodulation
9 of the data signal without reference to the one or more
10 supplemental signals.

1 29. A method for improved wireless communications
2 comprising:

3 producing a data signal;

4 producing a time-varying signal which changes
5 frequency during each of a plurality of periods, wherein
6 the frequency changes from one period to a subsequent
7 period in a predetermined sequence of frequencies within a
8 channel to be employed in transmitting the data; and

9 producing a transmission signal from a
10 combination of the data signal and the time-varying signal.

11 30. The method as set forth in Claim 29 wherein the
12 predetermined sequence spans the channel to directly
13 provide a frequency domain channel estimate.

14 31. The method as set forth in Claim 29 wherein the
15 predetermined sequence is coordinated with a field sync
16 within the data signal.

17 32. The method as set forth in Claim 29 wherein the
18 time-varying signal is provided with a power selected to
19 minimize interference with demodulation of the data signal
20 without reference to the time-varying signal.

33. The method as set forth in Claim 29 wherein the time varying signal cycles through all frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the data signal.

1 34. The method as set forth in Claim 29 wherein the
2 predetermined sequence is coordinated with a field sync
3 within the data signal and wherein the time-varying signal
4 is transmitted with a power selected to minimize
5 interference with demodulation of the data signal without
6 reference to the time-varying signal.

1 35. The method as set forth in Claim 29 wherein the
2 time-varying signal is one of a plurality of time-varying
3 signals each having a different frequency during a period
4 and each changing frequency from one period to a subsequent
5 period in the predetermined sequence of frequencies.

1 36. A method for improved wireless communications
2 comprising:

3 receiving a signal;

4 producing the channel estimate from the received
5 signal and a time-varying signal corresponding to a portion
6 of the received signal, wherein the time-varying signal
7 changes frequency during each of a plurality of periods,
8 wherein the frequency changes from one period to a
9 subsequent period in a predetermined sequence of
10 frequencies within a channel on which the received signal
11 is received; and

12 performing channel equalization on the received
13 signal utilizing the channel estimate.

14 37. The method as set forth in Claim 36 further
15 comprising:

16 producing the time varying-signal with a period
17 duration and the predetermined sequence matching a
18 corresponding period duration and predetermined sequence
19 employed in generating the received signal.
20

1 38. The method as set forth in Claim 37 further
2 comprising:

3 producing a plurality of time-varying signals
4 each having a different frequency during a period and each
5 changing frequency from one period to a subsequent period
6 in the predetermined sequence of frequencies, wherein the
7 channel estimate is produced from the received signal and
8 each of the time-varying signals.

1 39. The method as set forth in Claim 36 wherein the
2 predetermined sequence spans frequencies within the channel
3 to directly provide a frequency domain channel estimate.

1 40. The method as set forth in Claim 36 wherein the
2 predetermined sequence is coordinated with a field sync
3 within the received signal.

1 41. The method as set forth in Claim 36 wherein the
2 time varying frequency cycles through all frequencies
3 within the predetermined sequence at a rate sufficient to
4 permit multiple channel estimates for a single field of the
5 received signal.

1 42. The method as set forth in Claim 36 further
2 comprising:

3 smoothing the channel estimate, tracking time
4 varying fades within the channel estimate, and producing
5 Doppler estimates for the channel estimate.

1 43. A wireless communication signal comprising:
2 a data signal; and
3 at least one supplemental signal combined with
4 the data signal, the at least one supplemental signal
5 having a frequency which changes during each of a plurality
6 of periods in a predetermined sequence of frequencies for a
7 channel in which the wireless communication signal is
8 transmitted.

1 44. The wireless communications signal as set forth
2 in Claim 43 wherein the predetermined sequence of
3 frequencies spans the channel.

1 45. The wireless communications signal as set forth
2 in Claim 43 wherein the predetermined sequence is
3 coordinated with a field sync within the data signal.

1 46. The wireless communications signal as set forth
2 in Claim 43 wherein at least one supplemental signal sweeps
3 the predetermined sequence at a rate sufficient to permit
4 multiple channel estimates based on the at least one
5 supplemental signal within a single field of the data
6 signal.

1 47. The wireless communications signal as set forth
2 in Claim 43 wherein at least one supplemental signal has a
3 power sufficiently less than a power for the data signal to
4 permit demodulation of the data signal without reference to
5 the at least one supplemental signal.

1 48. The wireless communications signal as set forth
2 in Claim 43 wherein at least one supplemental signal
3 further comprises:

4 a plurality of supplemental signals each having a
5 different frequency during a given period and each changing
6 frequencies in the predetermined sequence from one period
7 to a subsequent period.

1 49. The wireless communications signal as set forth
2 in Claim 43 wherein wireless communications signal is a
3 result of modulating the combination of the data signal and
4 the at least one supplemental signal.